

Evaluating the effectiveness of PESS Departments' Undergraduate Programs in Greek Universities, in terms of their correlation with PE School Curriculum: Creation and implementation of a criteria-based instrument

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Abstract The purpose of this research is to evaluate the correlation between the undergraduate programs (Higher Education) offered by Departments of Physical Education and Sport Science (DPRESS) and the Physical Education (PE) curriculum followed in Greek Primary (years 6-12) school and Middle (years 13-15) school. Specifically, we aimed to investigate whether the perspective PE teachers were adequately prepared to teach (after their graduation) the thirteen (13) main athletic subjects of the PE school curriculum. Fifteen (15) criteria were developed, in order to evaluate whether the athletic subjects offered by the departments, as described within their annual undergraduate catalogs, adequately prepare their graduates to teach PE in Primary and Middle school. Useful conclusions were drawn concerning: a) the mean values of the fifteen criteria, b) the Trigonometric transformation of the Multidimensional Scaling solutions (MDS-T), which eventually included thirteen of the fifteen criteria, and c) other selected criteria of the fifteen criteria-based matrix.

Keywords: *evaluation, undergraduate programs, higher education, undergraduate catalogs, physical education, teacher education*

Cite This Article: Chris P. Lamprou, Costas M. Mountakis, Sofia Th. Papazoglou, Nikitas N. Nomikos, "Evaluating the effectiveness of PESS Departments' Undergraduate Programs in Greek Universities, in terms of their correlation with PE School Curriculum: Creation and implementation of a criteria-based instrument." *American Journal of Educational Research*, vol. 5, no. 11 (2017): 1120-1130. doi: 10.12691/education-5-11-2.

1. Introduction

Teacher education in Physical Education and Sport Science (PESS) in Greece is offered by five university departments: 1) in Athens (National and Kapodistrian University of Athens - NKUA), 2) in Thessaloniki (Aristotle University of Thessaloniki - AUTH), 3) in Komotini (Democritus University of Thrace - DUTH), 4) in Serres (Aristotle University of Thessaloniki - AUTH) and 5) in Trikala (University of Thessaly - UTH). These departments not only educate Physical Education (PE) teachers, but also cover all scientific aspects of PESS.

The evaluation of PE teacher education in Greece is a rather troublesome and multifaceted question. We deem that the most suitable approach to determine whether PE teacher education is adequate, is to compare the undergraduate programs of the five departments mentioned above, with the thirteen (13) main athletic subjects taught in Primary

school and Middle school. These are: 1) Gymnastics (Basic – Pedagogical), 2) Gymnastics with the use of Equipment, 3) Rhythmic Gymnastics, 4) Classical Athletics, 5) Basketball, 6) Volleyball, 7) Handball, 8) Football, 9) Traditional Greek Dance, 10) Psychomotor Education, 11) Music and Movement Education, 12) Games and 13) Swimming. At this point, it should be noted that our study focuses only on undergraduate programs ('first cycle' -or Bachelor's- Degree) and not on graduate ('second cycle' -or Master's- Degree) and/or postgraduate programs ('third cycle' or Ph.D. level). For the relevant theoretical framework, it is recommended for readers and/or researchers to collect useful information about ECTS [1] and ECTS-Users' Guide 2015 [2].

The present study aims to discuss these thirteen (13) athletic subjects, in order to determine whether the five Departments of Physical Education and Sport Science (DPRESS) prepare school teachers adequately. It should be mentioned that there are no suitable methodologies that allow us to evaluate undergraduate programs through a

direct comparison with school curriculum. Due to this fact it was necessary to devise and implement a criteria-based process to measure the correlation of the aforementioned athletic subjects in the official undergraduate catalogs of the five DPESS, with the thirteen (13) athletic subjects taught in Primary school and Middle school.

The research material covers the period from 1983 to 2008 and includes the following: a) the undergraduate catalogs of the five DPESS, b) the PE curriculum for Primary and Middle school [3-13]. Regarding the research material, the following should be noted:

1. The PE curriculum of Primary and Middle school for the period 1983-2008 were found from various sources, the main one being the archives of the Greek Pedagogical Institute. We further cross-referenced this information with interviews carried out with PE Advisors (of the Greek Pedagogical Institute).

2. Regarding the five DPESS, we attempted to locate undergraduate catalogs and information about the content of all undergraduate programs for every academic year of the set research scope. After submitting applications to each department's library and Student Administration office, we received a total of fifty three (53) detailed undergraduate catalogs [14,15,16,17,18]. In addition, six (6) were available online, in digital format [19,20,21,22,23]. Eventually, we managed to amass a total of fifty nine (59) undergraduate catalogs, covering the vast majority of the undergraduate programs over the total academic operational years, without risking the validity of our findings. Nevertheless, it is necessary to be aware of the limitations imposed by the sample of the obtained undergraduate catalogs; a greater sample would allow any prospective researcher(s) to get more accurate estimations. The research would have benefitted from a larger selection of undergraduate catalogs, and especially for the following academic years per department: 1) for AUTH's DPESS in Thessaloniki, for 1983-4 and 1987-1991; 2) for DUTH's DPESS in Komotini, for 1984-1990; and 3) for AUTH's DPESS in Serres, for 1987-1996, although one undergraduate catalog from AUTH's DPESS in Thessaloniki states that the Serres' DPESS offered the same undergraduate catalog with Thessaloniki.

Our study utilizes the following research methods [24,25,26,27,28]: a) the study of sources, archives and statistical data, b) content analysis, and c) Multidimensional Scaling solutions in Trigonometric transformations (MDS-T) [29,30,31]. Additionally, the main technique chosen for studying the archives, was the analysis and processing of the material. The resulting data from the analysis were collected, codified, quantified, and processed, with the use of statistical charts and tables, as well as with the Statistical Package for the Social Sciences software (SPSS).

2. The Scope of the Study

The present study compares the PE curriculum of Primary school and Middle school, with the content (learning objectives) of the undergraduate programs of the five DPESS in Greece (in Athens, Thessaloniki, Komotini, Serres and Trikala). Henceforth, the terms 'Analytical Program' (AP) and 'PE (school) curriculum' refer to both Primary school (Primary Education) and Middle school

(Secondary Education), while 'undergraduate program(s)', 'undergraduate catalog(s)', 'first-cycle degree program(s)', 'general catalog(s)', 'course catalog(s)' refer to DPESS (Higher Education). The term 'undergraduate catalog(s)', refers to department's undergraduate catalog/general catalog/course catalog, i.e. the information package that includes all the necessary information regarding the Institution, the Department, the Department's specific undergraduate program/first cycle degree program (e.g. the Department's function, the program structure, etc.) and other broad but useful information for students (e.g. student affairs office, study facilities, financial support for students, insurance, extra-mural and leisure activities, student associations etc.). It should be mentioned that the term 'curriculum' is used in our study, referring only to Primary and Secondary Education and not to Higher Education.

We chose to limit the study to the PE curriculum of Primary school ('Dimotiko' – years 6-12) and Middle school ('Gymnasio' – years 13-15), excluding High school ('Likeio' – years 16-18), for the following reasons: a) Primary school and Middle school constitute the 9-year compulsory education in Greece, b) the age from 6 to 15 years old is considered particularly important for shaping what role PE will play in a child's life and c) the underlying philosophy of Primary and Middle school PE curriculum in Greece is practically the same [32].

The time period (1983-2008) was selected because: a) the academic year 1983-4 saw the launching of the DPESS in Athens and Thessaloniki (former National PE Academies); b) 2008 was the final year before the reform plan for compulsory education (Cross Thematic Curriculum Framework - CTCF), which was introduced by the Greek Pedagogical Institute [33] and included the development of PE teaching material for teachers and pupils; c) the academic year 2007-8 marked the 25th anniversary since the establishment of the first two PESS departments in Athens and Thessaloniki (the 24th for Komotini's, the 23rd for the one in Serres, and the 14th for Trikala's), which was also the first year these departments, among all other Higher Education Institutions, were called by the Greek Ministry of Education to undergo internal and external evaluation procedures [34,35,36].

2.1. Limitations

The characteristics of the undergraduate programs and school curriculum, the existing Greek institutional and legal framework and the nature of the data were responsible for some limitations in our study, as presented below:

1. We were not able to analyze some undergraduate catalogs for specific academic years due to the fact that it had not been possible to retrieve them from the Student Administration offices or the University Libraries, because they had not kept records of them. However, all undergraduate catalogs that were made available to us, along with Proceedings of the Departments' General Meetings, were considered for our research. The Proceedings of the Departments' General Meetings provided complementary information about the undergraduate programs, especially in those cases that undergraduate

catalogs were not made available to us. It is recommended for future researchers to consult such departmental records in order to collect useful information.

2. Although there is no space for doubt about the accuracy of the PE curriculum for Primary school and Middle school, with regard to the five departments' detailed undergraduate programs, there is the likelihood that in some cases we processed indicative data and approximations, rather than factual data, as there are no single catalogs per academic year. This lack of clarity is also documented in many undergraduate catalogs, for instance regarding the allocated hours per week for each subject etc. However, even these approximations were deemed valuable to the research, as they constitute the elements of PE teacher education in the departments in question.
3. The present study draws upon the theories of McKnight, Goodland and Van den Alker regarding the classification of curriculum in levels of interpretation [37,38,39,40]. It focuses on the intended curriculum and critically evaluates the gap between theory (intention) and practice (i.e. what actually is taught in school). The multiple theories available on the classification of curriculum, not only reveal the complexity involved in their development but also make their evaluation an arduous task [40].
4. In the field of undergraduate programs, there are similar theories that express the scholars' concerns regarding their intention, implementation and effectiveness, which also complicate any evaluation attempts. Specifically, according to Radcliff [41], undergraduate programs, as a rule, can be described either by what is originally determined for and offered to students, or by what knowledge students gain through their academic experience. This distinction is represented in the difference between the questions: "What must students learn in an undergraduate program?" and "Which elements of an undergraduate program affect the students' learning?" According to Weiland [42], it is more suitable to evaluate undergraduate programs based on their objectives (learning objectives), rather than on their outcomes. Determining the actual learning outcomes of undergraduate programs can be troublesome. Most research on the evaluation of undergraduate programs and their learning outcomes is mainly hypothetical, rather than factual. Therefore, it is important here to make a distinction between programs that follow a rigid structure towards specific degree requirements, and studies in which students really choose for themselves.
5. Due to the nature of the research topic, our study was primarily based on literature coming from Greek sources, and secondarily from non-Greek sources.

2.2. The Research Question

From the foundation laid by the related curriculum in Primary school and Middle school, which has already

been referred to earlier, and from the analysis of the five departments' undergraduate catalogs, emerges the need to group and investigate the following thirteen (13) taught athletic subjects: 1) Gymnastics (Basic – Pedagogical), 2) Gymnastics with the use of Equipment, 3) Rhythmic Gymnastics, 4) Classical Athletics, 5) Basketball, 6) Volleyball, 7) Handball, 8) Football, 9) Traditional Greek Dance, 10) Psychomotor Education, 11) Music and Movement Education, 12) Games, and 13) Swimming.

These distinct educational subjects establish the required point of reference, based on which our research will attempt to evaluate the effectiveness and the correlation of PE curriculum in Primary school and Middle school and undergraduate programs in the five DPESS. First and foremost, it should be made clear that this study aims to define, through a set of criteria, the value or the weight of importance placed upon each of the aforementioned educational subjects in the design of each undergraduate program. We argue that this is a valid method in order to reach important conclusions about these educational subjects, measuring whether each undergraduate program placed greater or lesser importance upon them in the PE teacher education. At the same time, statistical analysis of the results can showcase whether there was a shift in the philosophy of the undergraduate programs for each department over the period 1983-2008.

The fifteen (15) criteria employed for the research emerged from the analysis of the five departments' undergraduate catalogs. The use of just a single criterion, or rather a smaller number of criteria, would not lead to satisfactory findings about the value placed in each taught athletic subject. This is also addressed within some catalogs, in an attempt to provide correct information to prospective students and lecturers of the five departments in question. For instance, one catalog for the undergraduate program in Serres (AUTH), when referring to the European Credit Transfer and Accumulation System (ECTS), states that "it would be inaccurate to weigh the importance of each athletic subject with its associated ECTS credits" and that "each subject's importance must be described within the department's undergraduate catalog." (AUTH-DPESS-Serres, catalog, 2007-8, p. 20) [22]. Although the undergraduate catalogs offer no further clarifications, the use of the verb "describe" implies that any research that aims to draw conclusions about the weight of importance of an athletic subject to the overall program, needs to originate from and rely on criteria emerging from the descriptions found in the departments' undergraduate catalogs. This view was adopted and employed in our study for each of the thirteen (13) athletic subjects, resulting in a total of fifteen (15) characteristics/criteria.

A few points need to be stressed here:

a) It is possible for a DPESS to include two or more Paths (including or not PE teacher education). Therefore, students are required to select some Path sub-subjects, offered in certain academic years and semesters. These Paths are not limited to PE teacher education, but can also extend to: 1) Health and Fitness, 2) Sport Coaching, 3) Sport Management.

b) All undergraduate catalogs of the five departments contain the common element of Specialization. In other

words, in the last one or two years of each undergraduate program, students could select at least one Sport Specialization, in order to obtain specialized Sports' Coaching qualifications. Therefore, students are also required to select some Specialized sub-subjects, offered in certain academic years and semesters. In some departments, this Specialization is not limited to Olympic or non-Olympic Sports, but can also extend to (more) theoretical Specializations, for instance, Athletic Journalism, Sports for All, Adapted Physical Education and Olympic Studies.

c) In any case, the DPESS Diploma encompasses many different fields, and graduates of any one of the five DPESS, are entitled to work in the corresponding professional field of PE in Primary, Secondary or Higher Education.

d) Every DPESS makes efforts to describe and distinguish each teaching subject according to the relevant instructions given by the Hellenic Quality Assurance and Accreditation Agency [36,43]. For this reason, all undergraduate catalogs divide the offered subjects into Compulsory (C.), Compulsory Elective (C.E.), and Optional (O.). Subjects are also categorized as Main Core (M.C.), Path (P.) or Specialized (SP.). Compulsory subjects are Core subjects. Compulsory Elective subjects can be of all three types (Core, Path, or Specialized). Optional subjects are Core subjects which can also function as Path or Specialized subjects, according to undergraduate program requirements. For example, when a Specialization in a particular sport is offered, without being included in the department's Compulsory subjects, the equivalent Optional subjects become prerequisites for students who want to follow this Specialization.

At this point, it should be noted that we decided against using the proposed subject classification of Hellenic Quality Assurance and Accreditation Agency, in Foundation subjects, Scientific Areas subjects, General Education subjects and Skill Development subjects [36,43] for the following reasons: a) it didn't serve the basic objective of our research, b) the additional evidence and conclusions, which would probably enrich our study, were neither safe nor valid. This classification of subjects would not be practical, due to the number and variety of PESS programs, Paths and Specializations.

2.3. The Fifteen (15) Criteria

The criteria selected for the evaluation of the thirteen (13) main athletic subjects of the university departments' undergraduate catalogs for PESS were the following:

1. The Number of Sub-Subjects (N.S.S.) relevant to a main athletic subject. We provide the mean value(s) of athletic sub-subjects offered per department, according to the undergraduate catalogs, which are relevant to the main athletic subject, for every academic year each department was fully operational (i.e. it offered all four years required for the completion of the undergraduate program).
2. The Number of different Semesters (N.S.) in which sub-subjects, relevant to a main athletic subject, are offered. The mean value of semesters will be used here.

3. The Number of Compulsory Sub-Subjects (N.C.S.S.) relevant to a main athletic subject. The mean value for each department was recorded.
4. The Number of Compulsory Elective Sub-Subjects (N.C.E.S.S.) relevant to a main athletic subject. The mean value for each department was recorded.
5. The Number of Optional Sub-Subjects (N.O.S.S.) relevant to a main athletic subject. The mean value for each department was recorded.
6. The Percentage of Compulsory Sub-Subjects (P.C.S.S.) relevant to a main athletic subject of the total number of compulsory subjects required for the completion of the undergraduate program.
7. The Number of Main Core Sub-Subjects (N.M.C.S.S.) relevant to an athletic subject. The mean value for each department was recorded. The word 'Main' is used in order to make a clear distinction between the abbreviation for criterion no.3 (N.C.S.S) and the abbreviation for criterion no.7 (N.M.C.S.S.).
8. The Number of Path Sub-Subjects (N.P.S.S.) relevant to a main athletic subject. The mean value for each department was recorded.
9. The Number of Specialized Sub-Subjects (N.SP.S.S.) relevant to a main athletic subject. The mean value for each department was recorded.
10. Subject Hours Per Week (S.H.P.W.). There is no distinction among theory, practice, laboratory work, and seminar hours for each subject. For this study, we only recorded what was written in each undergraduate catalog. It is the mean value of hours sub-subjects relevant to a main (athletic) subject were taught in each department.
11. Teaching Credits (according to the European Credit Transfer System-ECTS or not) [1,2,44,45] (T.C./ECTS) associated with the main (athletic) subject. It is the mean value of teaching credits of all sub-subjects relevant to the main (athletic) subject per department. (ECTS is a learner-centered system for credit accumulation and transfer, based on the principle of transparency of learning, teaching and assessment processes. Its objective is to facilitate planning, delivery and evaluation of study programs and student mobility by recognizing learning achievements and qualifications and periods of learning.).
12. Percentage of the Number of total Teaching Credits originating from Compulsory Sub-Subjects (P.N.T.C.C.S.S.) relevant to a main (athletic) subject, from the total number of minimum teaching credits required for graduation. The mean value for each department was recorded.
13. The Order (ORDER) in which every sub-subject's 'syllabus' are presented among others within each undergraduate catalog. (The term "syllabus" is officially used to describe the content of every teaching sub-subject, in Ministerial Decisions, No. F5/89565/B3/2007 [44]). The order in these descriptions is related to: a) whether the sub-subject is Compulsory (a Core subject) or Compulsory Elective (Core, Path, or Specialized) or Optional

(Core, Path, or Specialized), b) whether the sub-subject is delivered from the first to the eighth semester and c) whether the sub-subject is considered –always according to the undergraduate catalog, and therefore, the department– a fundamental study. The last characterization should not be confused with the subjects’ classification into Foundation subjects, Scientific Areas subjects, General Education subjects and Skill Development subjects, which is not utilized in our study.

14. The Preparatory (PREPARATORY): [YES]-[Not Registered]-[NO]: [1]-[0]-[-1] pertains to whether the sub-subject prepares students to become PE teachers. This attribute is triggered when particular words and phrases referring to PE teaching in Primary and Secondary Education are identified within each undergraduate catalog, or when words and phrases referring to the sciences of Educational Psychology, Developmental Psychology, Pedagogy, Teaching Methods of Physical Education generally or Teaching Methods of main athletic subjects (thirteen/13 main athletic subjects of Primary and Middle school’s curriculum). The positive identification of these characteristics shows in part that the teaching of this subject has been harmonized with the sciences referred to.
15. (SPECIALIZATION): (YES)-(NO): (1)-(0): Specialization has been offered in all DPESS since their first academic year. This attribute refers to whether Specialization in the main athletic subject in question was offered by each of the five DPESS.

3. Results

The Statistical processing of data with the use of trigonometrically transformed Multidimensional Scaling solutions (MDS-T)

The statistical analysis followed a two-stage process. First, the structure of the fifteen (15) criteria was explored by computing trigonometrically transformed Multidimensional Scaling solutions (MDS-T) [29,30,46,47]. The MDS-T method involves first analyzing the data through standard unconstrained Multidimensional Scaling analysis (MDS) [48,49,50] followed by trigonometric transformations of the coordinates on the circumference of a circle [29,30,46] or on the surface of a sphere. (A software application for computing two- and three-dimensional MDS-T solutions and graphically displaying them, programming by G. Santipantakis [51], can be freely downloaded. This application was developed as part of the Papazoglou & Mylonas publication [47]). These trigonometric transformations aim at simplifying the patterns present on the initial two- or three-dimensional MDS configuration. The distances of the points from the origin are not considered, and the researcher is interested in the relative positions of the items on the same continuum (circle) or surface (sphere). Homogeneous groups of items/stimuli can become apparent on the circular continuum or spherical surface which are formed by items on the same or neighboring points [29,30,31,46,47,52,53,54,55]. The homogeneous groups

are interpreted according to the properties of the items belonging to them.

In the present study, the dissimilarities between the 15 criteria were analyzed using the ALSICAL algorithm [56,57] in two dimensions, followed by trigonometric transformations of the coordinates on the circumference of a circle. Second, the homogeneous groups of criteria resulting from MDS-T will allow us to classify the athletic subjects for each department or for all departments as a whole. In other words, in this stage, after locating the 15 criteria on the circumference of the circle and identifying homogeneous groups representing broader (grouped) criteria, we investigate what subject groupings emerge from the entire measuring process, i.e. for all departments, all main athletic subjects and all undergraduate programs, and then for each individual department.

Early in the first stage, by applying exploratory MDS analyses, we found that criteria 2 (N.S.) and 13 (ORDER) are not compatible, as they are completely different from the rest, and don’t conform to this structure – in multidimensional scaling there is a great distance compared to the other thirteen (13) measurements (thirteen criteria). For this reason, a structure was computed that includes, for all departments, only the remaining thirteen criteria, in order to classify the main athletic subjects in the next stage.

It should also be mentioned that the MDS-T method has two goodness-of-fit criteria: S-Stress and R². If S-Stress > 0.13, the solution is somewhat unstable. In all the solutions we proceeded with, we had S-Stress<0.08; therefore, there was no issue of statistical stability. Furthermore, in all cases, the R² value was very high – i.e. R² approached 1.

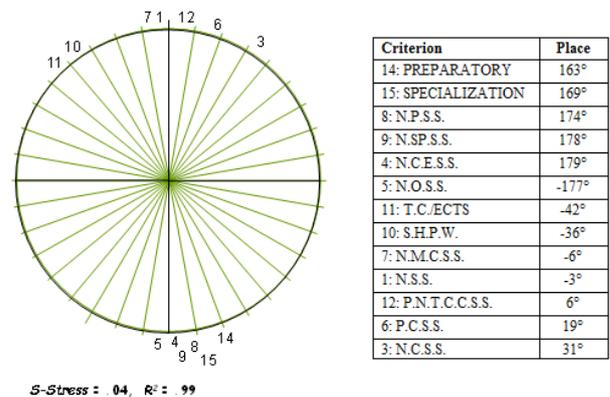


Figure 1. MDS-T configuration for the (13) criteria (and their Place) in all five (5) departments. (Column named as ‘Place’ corresponds to each criterion’s position on the circumference of the circle, as displayed in the respective Figure, expressed in degrees, according to the angle it forms with the vertical Y axis.)

The configuration for all departments combined shows that six criteria (4 “N.C.E.S.S.”, 5 “N.O.S.S.”, 8 “N.P.S.S.”, 9 “N.SP.S.S.”, 14 “PREPARATORY”, and 15 “SPECIALIZATION”) form one homogeneous group of criteria, while the remaining seven criteria (1 “N.S.S.”, 3 “N.C.S.S.”, 6 “P.C.S.S.”, 7 “N.M.C.S.S.”, 10 “S.H.P.W.”, 11 “T.C./ECTS”, and 12 “P.N.T.C.C.S.S.”) form another homogeneous group. Neighboring criteria with distance greater than 30 degrees on the circumference of the circle were placed in different groups. The two groups of criteria

that emerged can be used in order to draw conclusions about and make comparisons among the thirteen (13) main athletic subjects for all departments.

However, although these two groups of criteria emerge from the collective findings for all five departments, the structure may be different for the individual departments; therefore, the MDS-T solutions for each of the five departments separately were also calculated, in order to identify patterns that will enable the analysis in the second stage of the study. In the second stage, we will classify the thirteen (13) main athletic subjects accordingly, not only for all departments, but also for each individual department.

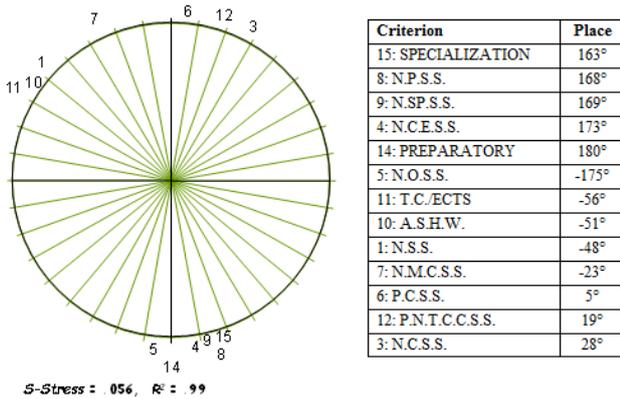


Figure 2. MDS-T configuration for the thirteen (13) criteria (and their Place) in DPESS in Athens (NKUA)

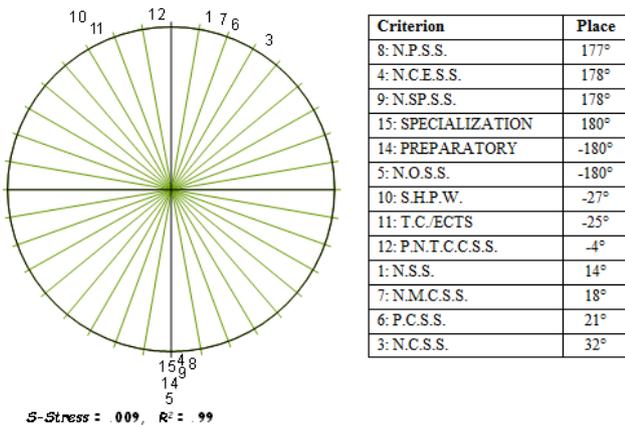


Figure 3. MDS-T configuration for the thirteen (13) criteria (and their Place) in DPESS in Thessaloniki (AUTH)

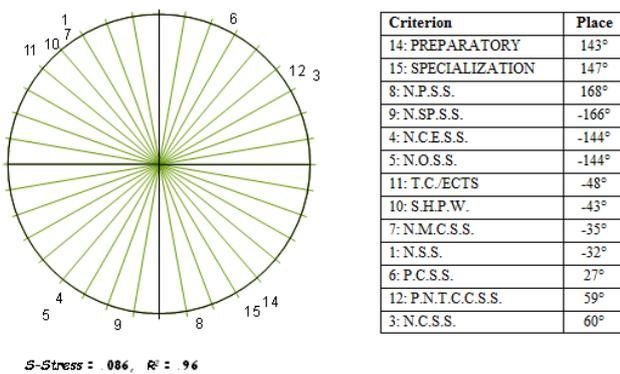


Figure 4. MDS-T configuration for the thirteen (13) criteria (and their Place) in DPESS in Komotini (DUTH)

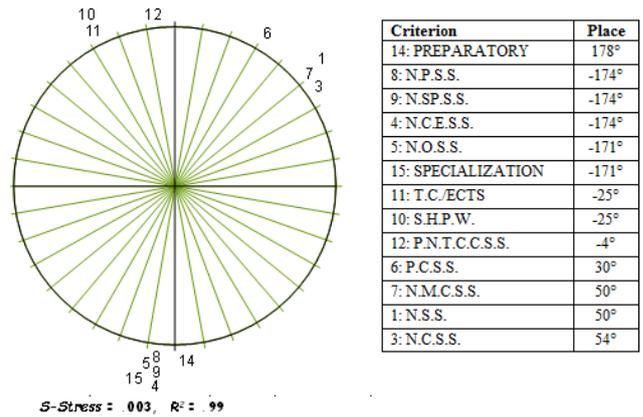


Figure 5. MDS-T configuration for the thirteen (13) criteria (and their Place) in DPESS in Serres (AUTH)

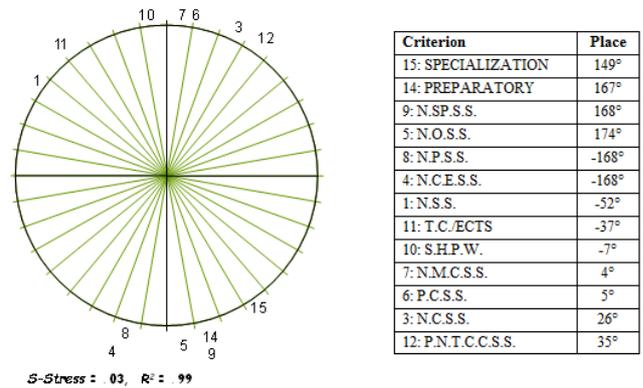


Figure 6. MDS-T configuration for the thirteen (13) criteria (and their Place) in DPESS in Trikala (UTH)

The above figures illustrate the resulting groupings of the thirteen (13) criteria based on MDS-T for the data of each DPESS separately. Based on this data, we can proceed to classify the main athletic subjects for our entire sample.

The groups of criteria in the above figures, through MDS-T, can result to one or more new tables, pertaining to the solution with the Cluster Analysis method. This type of analysis (Cluster Analysis) would produce a classification for all “cases”, where each case represents one main athletic subject, in each department, for each academic year [49]. (The relevant Cluster Analysis Tables referred to in the following section are available upon request by corresponding author. From this point on, wherever criteria are mentioned, these concern the six MDS-T. Wherever there is a mention upon subjects, this concerns the cluster analysis, i.e. tables which are not included in body of the article.)

The study of all findings for all DPESS reveals a broad, yet accurate, picture, according to which, the thirteen (13) main athletic subjects are divided into two major groups: the first group includes main athletic subjects 10, 11 and 12 (Psychomotor Education, Music and Movement Education and Games respectively), and the second group includes the remaining ten subjects. However, the classification that emerged is somewhat unclear, as certain cases did not fall under the expected groupings. Normally, we would expect a clean solution, with two clusters: one containing 120 cases (for each subject), and the other

containing 0 (null), – nevertheless, this is not the case here. We could further search this irregularity by conducting the same analysis for each department, thus a total for 312 cases in each one.

For the DPESS in Athens (NKUA), the MDS-T grouping of criteria was somewhat different from the one representing the results for all five departments. When we attempt to classify the thirteen (13) main athletic subjects, two groups/clusters emerge: the first includes 1, 4, 5, 6, 7, 8, 9, and 13 (i.e. Gymnastics, Classical Athletics, Basketball, Volleyball, Handball, Football, Traditional Greek Dance, and Swimming, respectively); the second includes 10, 11 and 12 (i.e. Psychomotor Education, Music and Movement Education and Games). Subjects 2 and 3 (Gymnastics with the use of Equipment and Rhythmic Gymnastics) were the only cases not clearly allocated to either of the two groups/clusters. With the exception of these two main subjects (2 and 3), for the Athens department, we have a very clear result – it should be noted that these two subjects are not classified in the first group/cluster, but rather in the second.

The DPESS in Thessaloniki (AUTH) shows a similar picture to the MDS-T solution of all departments combined, as two criteria groups emerge. According to the classification of main athletic teaching subjects, the first cluster includes 10, 11 and 12 (Psychomotor Education, Music and Movement Education and Games), and the second all the remaining ones.

For the DPESS in Komotini (DUTH), four groups of criteria emerge, in two dimensions – all other MDS-T solutions resulted in groupings in one dimension (bipolarity). In regards with the classification of the main athletic subjects, three cluster analysis solutions were attempted, but no significant differentiations were observed; therefore all subjects for the department in Komotini form one cluster.

In the results for the DPESS in Serres (AUTH) three groups of criteria were formed. The subsequent classification of the main athletic subjects resulted in two clear clusters, the one consisting of 10, 11 and 12 (Psychomotor Education, Music and Movement Education and Games) and the other of all the remaining ones.

The criteria groups for the results for the DPESS in Trikala (UTH) were also three, but they were structurally different to the Serres's department grouping. In other words, while one of the three criteria groups is identical to one group from the Serres's criteria grouping, the other two include the remaining criteria reshuffled. Subsequently, two cluster analysis solutions emerge from the classification of the main athletic subjects: one with two and one with three clusters – yet, no subjects show any significant deviations. However, the two-cluster solution allows us to conclude that subjects 10, 11, and 12 (Psychomotor Education, Music and Movement Education and Games), again, show a slight differentiation from the remaining main athletic subjects.

Overall, after the analysis of the results for each department, we can reach the conclusion that main athletic subjects 10, 11 and 12 (Psychomotor Education, Music and Movement Education and Games) consistently form a separate cluster from all other subjects. For the departments of Athens and Thessaloniki the cluster analysis follows the same pattern, if we exclude subjects 2

and 3 (Gymnastics with the use of Equipment and Rhythmic Gymnastics) for the department of Athens. For the department in Komotini, after considering all thirteen (13) criteria, all subjects belong in a single cluster – in other words, there are no divergent patterns among the main athletic subjects. Conversely, for the department of Serres we have a clear cluster analysis solution, while for the department of Trikala, two equivalent clusters emerge, where main athletic subjects 10, 11, and 12 show, again, a slight differentiation.

4. Discussion

In this section we present the Observations from the analysis of Undergraduate Catalogs and their corresponding Undergraduate Programs

4.1. Based on the Mean Values of the Criteria

The relevant Mean Value Tables referred to in the following section are available upon request by corresponding author. The tables of mean values, resulting from the processing of the five departments' undergraduate catalogs, lead us to certain overall observations about the teaching of the thirteen (13) main athletic subjects (for each academic year they were offered) in the undergraduate programs of these departments.

DPESS in Athens (NKUA): According to the final highest and lowest mean values of the main athletic subjects' criteria ranking, it seems that this department's undergraduate programs placed greater emphasis on 4, 6, 5, 8, 7, and 13 (Classical Athletics, Volleyball, Basketball, Football, Handball, and Swimming), than they did on 12, 10 and 11 (Games, Psychomotor Education, Music and Movement Education). It is noteworthy that –in the undergraduate catalogs– there were no Compulsory (C.) sub-subjects found that can be associated with these main athletic subjects – however, they were covered by Compulsory Elective (C.E.) and Optional (O.) subjects, functioning as Main Core (M.C.), Path (P.) or Specialized (SP.) subjects. Therefore, it can be argued that the PE teacher education in these particular subjects was inadequate in this department.

DPESS in Thessaloniki (AUTH): The final highest and lowest mean values of the main athletic subjects' criteria ranking reveal that the undergraduate program mostly emphasized on 1, 4, 6, 2, 7, and 5 (Gymnastics, Classical Athletics, Volleyball, Gymnastics with the use of Equipment, Handball, and Basketball), rather on 12, 10, and 11 (Games, Psychomotor Education, Music and Movement Education). The PE teacher education for these three subjects relied, not only on Compulsory (C.) and Main Core subjects (M.C.), but also on Compulsory Elective (C.E.) and Optional (O.), as well as on Path (P.) and Specialized (SP.) subjects.

DPESS in Komotini (DUTH): According to the final highest and lowest mean values of the main athletic subjects' criteria ranking, it seems that this department's undergraduate program placed greater emphasis on 5, 4, 6, 8, 13, and 9 (Basketball, Classical Athletics, Volleyball, Football, Swimming, and Greek Traditional Dance), than it did on 12, 10, and 11 (Games, Psychomotor Education,

Music and Movement Education). Especially, in regards with 11 (Music and Movement Education), although this department ranked high in several criteria, it had the second lowest ranking for criterion 3 (N.C.E.S.S.) – as a result, this main athletic subject is far from being considered adequately covered. Regarding 10 and 12 (Psychomotor Education and Games), no independent Compulsory (C.) sub-subjects were found, which reveals that these main athletic subjects were inadequately covered – conversely, they relied on Compulsory Elective (C.E.), Optional (O.) and Path (P.) subjects.

DPESS in Serres (AUTH): The final highest and lowest mean values of the main athletic subjects' criteria ranking showed that this department's undergraduate program mostly emphasized on 4, 5, 6, 7, 8, and 1 (Classical Athletics, Basketball, Volleyball, Handball, Handball, Football, and Gymnastics), rather on 12, 10, and 11 (Games, Psychomotor Education, Music and Movement Education). For subjects 12 and 10, no stand-alone Compulsory (C.) sub-subjects were found, indicating that they were insufficiently covered. The PE teacher education for main athletic subjects 10, 11 and 12 relied on Optional (O.) sub-subjects.

DPESS in Trikala (UTH): According to the final highest and lowest mean values of the main athletic subjects' criteria ranking, it seems that this department's undergraduate program placed greater emphasis on 4, 5, 6, 1, 13, 8 and 9 (Classical Athletics, Basketball, Volleyball, Gymnastics, Swimming, Football and Traditional Greek Dance), than it did on 12, 10, and 11 (Games, Psychomotor Education, Music and Movement Education). For subjects 12 and 10, no stand-alone Compulsory (C.) sub-subjects were found, indicating that they were insufficiently covered. The PE teacher education for main athletic subjects 10, 11 and 12 relied on Compulsory Elective (C.E.), Optional (O.), Path (P.) and Specialized (SP.) sub-subjects.

For all five DPESS: By studying the final mean values of the main athletic subjects' criteria ranking in all departments, we observe a general emphasis on 4, 5, 6, 1, 8, 7, and 13 (Classical Athletics, Basketball, Volleyball, Gymnastics, Football, Handball, and Swimming, which rank the highest), rather on 12, 10, and 11 (Games, Psychomotor Education, Music and Movement Education, which rank the lowest).

4.2. Based on the MDS-T

The MDS-T solutions lead us to a number of interesting observations, not only about the thirteen (13) main athletic subjects, but also about the fifteen (15) criteria used during the analysis of the undergraduate programs and their undergraduate catalogs for each academic year.

Based on the solution for the collective findings from all departments (Figure 1), the thirteen (13) criteria (out of the fifteen originally selected) form two groups: the first includes criteria 1 (N.S.S.), 3 (N.C.S.S.), 6 (P.C.S.S.), 7 (N.M.C.S.S.), 10 (S.H.P.W.), 11 (T.C./ECTS), and 12 (P.N.T.C.C.S.S.); and the second contains criteria 4 (N.C.E.S.S.), 5 (N.O.S.S.), 8 (N.P.S.S.), 9 (N.SP.S.S.), 14 (PREPARATORY), 15 (SPECIALIZATION). In regard to our research problem, we deem that the first criteria group has an increased importance value in comparison to

the second – in other words, we can refer to them as primary and secondary criteria groups. The solutions for each department confirm this criteria grouping but also show a few subsets. However, in order to compensate for the limitations pertaining to the data collection, as explained earlier in this article, we opted to select the general grouping explained above as *primary* and *secondary* criteria groups, which is also recommended for future studies.

For instance, when we attempt to evaluate the presence of each of the thirteen (13) main athletic subjects for any department over the undergraduate program of its operation years, we may select the three criteria that pertain to Compulsory subjects: 3 (N.C.S.S.), 6 (P.C.S.S.), and 12 (P.N.T.C.C.S.S.) – their mean value for each academic year yields adequate information on the presence of relevant compulsory subjects within an undergraduate program, while taking into account the total number of compulsory subjects, as well as the number of teaching credits associated with the chosen main athletic subject. All three criteria in the above example belong to the *primary* group. (The relevant Mean Value Diagrams of the three Criteria 3, 6, 12, referred to in the sections that follow, are available upon request by corresponding author.)

One additional criterion of the same group, which adequately informs about the PE teacher education on a chosen main athletic subject, is 1 (N.S.S.). Regardless of the sub-subjects' category, i.e. whether they are Compulsory (C.), Compulsory Elective (C.E.), Optional (O.), Main Core (M.C.), Path (P.) or Specialized (SP.), the value for 1 (N.S.S.), in other words the total number of different sub-subjects relevant to a main athletic subject within a department's undergraduate program, indicates the department's staff and students' educational interest towards that main athletic subject.

The MDS-T solutions for all departments and for each department individually (for the years of operation that coincide with the research scope) reveal a similar educational interest and strategy for PE teacher education in nearly all thirteen (13) main athletic subjects: the results show that only 10, 11 and 12 (Psychomotor Education, Music and Movement Education and Games) are treated differently than the rest. The MDS-T solutions show that this observation is consistent in all departments, with the exception of Komotini: although 10, 11, and 12 also diverge from the general educational strategy followed in the remaining main athletic subjects, the difference is less significant than the one observed in the other departments.

4.3. Based on Selected Criteria

Eventually, the above analysis reveals that the five departments, in their years of operation, overall emphasized on main athletic subjects 4, 5, 6, 1, 8, 7, and 13 (Classical Athletic, Basketball, Volleyball, Gymnastics, Football, Handball, and Swimming) in their undergraduate programs. Contrastingly, as the mean values of criteria 3 (N.C.S.S.), 6 (P.C.S.S.), 12 (P.N.T.C.C.S.S.), and 1 (N.S.S.) indicate, main athletic subjects 12, 10, and 11 (Games, Psychomotor Education, Music and Movement Education) were not adequately covered.

Specifically, in the DPESS in **Athens**, there are no Compulsory (C.) sub-subjects for Psychomotor Education,

Music and Movement Education or Games (10, 11, or 12) for the academic years from 1984/5 to 2007/8. Further, for the academic years from 1984/5 to 1993/4, there are no sub-subjects of any category relevant to Psychomotor Education (10), and from 1984/5 to 2004/5 no sub-subjects relevant to Games (12).

In a similar fashion, in the DPESS in **Thessaloniki**, for the academic years from 1991/2 to 2007/8, no Compulsory (C.) sub-subjects are found for either Psychomotor Education (10) or Games (12), nor for Music and Movement Education (11) from 1998/9 to 2007/8. Additionally, there are no records of any sub-subjects (of any category) relevant to either Psychomotor Education (10) or Games (12) for the academic years from 1991/2 to 1993/4.

DPESS in **Komotini** started operating in the academic year 1984/5. In regards with the presence of Compulsory (C.) sub-subjects, all thirteen (13) main athletic subjects return null values for the academic years from 1993/4 to 1995/6. Furthermore, from 1986/7 to 2007/8, no Compulsory (C.) sub-subjects are found for either Psychomotor Education (10) or Games (12), and from 1993/4 to 1996/7 and from 2004/5 to 2007/8, no sub-subjects are found for Music and Movement Education (11). Also, no sub-subjects of any category are found for Games (12) from 1993/4 to 1995/6.

DPESS in **Serres** started operating in 1985/6. No Compulsory (C.) sub-subjects are found for either Psychomotor Education (10) or Games (12) for the academic years from 1987/8 to 2007/8, nor for Music and Movement Education (11) from 1998-9 to 2007-8. Furthermore, regardless of categories, no sub-subjects are found for either Psychomotor Education (10) or Games (12) from 1988/9 to 1999/2000.

DPESS in **Trikala** started operating in 1994/5. No Compulsory (C.) sub-subjects are identified for either Psychomotor Education (10) or Games (12) for the period from 1994/5 to 2007/8, nor for Music and Movement Education (11) from 1997/8 to 1998/9. In addition, no sub-subjects of any categories are identified for either Psychomotor Education (10) in 1998/9 or for Games (12) over the period from 1998/9 to 2007/8.

5. Conclusions

The criteria matrix employed for the evaluation of the undergraduate programs of DPESS for 1983-2008 allowed us to establish that a number of main athletic subjects – Classical Athletics, Basketball, Volleyball, Gymnastics, Football, Handball, and Swimming, which had the highest mean values– were favored over others, namely Games, Psychomotor Education and Music and Movement Education, which had the lowest ones. We deem that the PE teacher education on the latter was not adequate.

It is encouraging, therefore, for PE teacher education that a satisfactory number of main athletic subjects of essential value for the Primary and Middle schools' curriculum returned high mean values. This indicates that the departments' students were adequately prepared for teaching them in schools. Nevertheless, it raises serious criticism the fact that main athletic subjects of equal importance, namely Psychomotor Education (10) and

Music and Movement Education (11), occupy two of the three lowest scores –the third being Games (12)– in the mean values. These results illustrate the undergraduate programs' inadequacy in PE teacher education and the lack of effective design of higher education policy for these main athletic subjects. This finding is in accordance with the result from a prior research [58,59].

In practice, this reveals that graduates of the five DPESS who are later appointed to teach PE in Primary school and Middle school have never actually been taught those three main athletic teaching subjects, either because they were never included in the department's undergraduate catalog or because they were only taught as Compulsory Elective (C.E.) and Optional (O.) sub-subjects in undergraduate DPESS programs, which, however, students did not select.

As a result, important deviation problems emerged with the PE curriculum of Primary and Middle school [58,59]. This entails consequent demands for supplementary training for the future PE teachers as well as the re-programming of PE teaching in Primary and Secondary Education by the Greek Ministry of Education.

Finally, it is known that the adaptation of an existing process/instrument to another culture and/or language can be a strenuous and ongoing procedure. Thus, researchers are encouraged to use the process/instrument of the current study in other countries/national educational systems, after applying the appropriate amendments and/or adjustments.

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